J. B. M. Clark

# CON CTICUT VALLEY

# FLOOD CONTROL

Hartford and East Hartford, Conn.

CORPS OF ENGINEERS, U. S. ARMY

PROVIDENCE DISTRICT

PROVIDENCE, R. I.

April, 1938

407-362

# CONNECTICUT RIVER

# FLOOD CONTROL PROJECT

U. S. ENGINEER OFFICE

PROVIDENCE, R. I.

APRIL, 1938.

The Connecticut River Basin extends from northern New Hampshire and the Province of Quebec to Long Island Sound. The eastern limits of the watershed lie in the White Mountains, in New Hampshire. The western divide of the watershed lies largely in the Green Mountains of Vermont and the Berkshire Hills in Massachusetts. The greatest length of the basin is about 280 miles and its greatest width about 62 miles. The total drainage area is 11,260 square miles, distributed as follows:

| | | |
|---|---|---|
| Canada | 115 | square miles |
| New Hampshire | 3,096 | " " |
| Vermont | 3,911 | " " |
| Massachusetts | 2,712 | " " |
| Connecticut | 1,426 | " " |

TABLE I

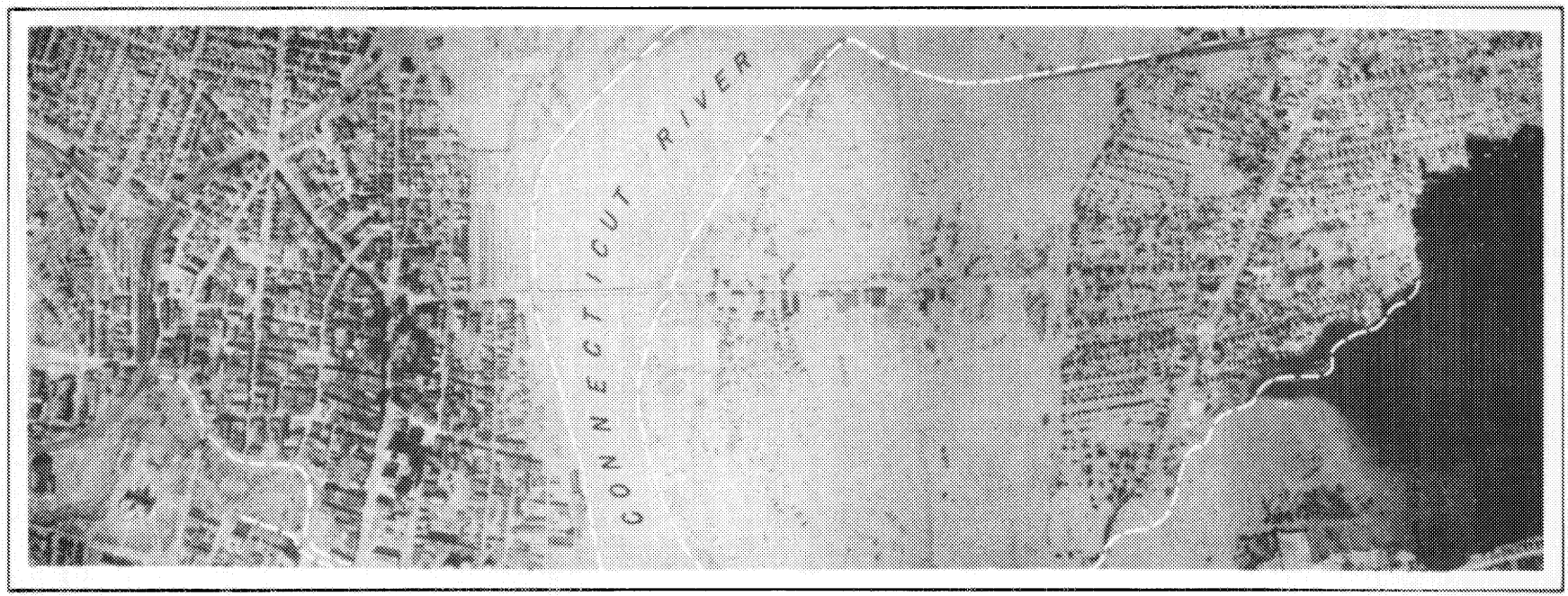
TRIBUTARIES, CONNECTICUT RIVER

| Stream | State | Enters Connecticut River: At Mile above Mouth | Left or Right | Drainage Area in Square Miles: Tributary | Connecticut River above Confluence |
|---|---|---|---|---|---|
| Nulhegan | Vt. | 344.5 | Right | 151 | 651 |
| Upper Ammonoosuc | N. H. | 324.7 | Left | 260 | 945 |
| Israel | N. H. | 312.0 | Left | 130 | 1,266 |
| Passumpsic | Vt. | 279.4 | Right | 507 | 1,651 |
| Ammonoosuc | N. H. | 266.2 | Left | 402 | 2,227 |
| Wells | Vt. | 265.9 | Right | 99 | 2,629 |
| Waits | Vt. | 246.8 | Right | 146 | 2,866 |
| Ompompanoosuc | Vt. | 224.3 | Right | 136 | 3,155 |
| White | Vt. | 215.2 | Right | 710 | 3,358 |
| Mascoma | N. H. | 214.2 | Left | 195 | 4,068 |
| Ottauquechee | Vt. | 210.2 | Right | 223 | 4,302 |
| Sugar | N. H. | 195.3 | Left | 274 | 4,674 |
| Black | Vt. | 183.1 | Right | 197 | 5,034 |
| Williams | Vt. | 176.4 | Right | 117 | 5,263 |
| West | Vt. | 149.2 | Right | 423 | 5,744 |
| Ashuelot | N. H. | 139.8 | Left | 420 | 6,247 |
| Millers | Mass. | 126.0 | Left | 390 | 6,741 |
| Deerfield | Mass. | 119.1 | Right | 665 | 7,174 |
| Chicopee | Mass. | 80.4 | Left | 724 | 8,303 |
| Westfield | Mass. | 75.0 | Right | 520 | 9,075 |
| Scantic | Conn. | 59.5 | Left | 113 | 9,716 |
| Farmington | Conn. | 57.1 | Right | 613 | 9,835 |
| Salmon | Conn. | 17.8 | Left | 152 | 10,927 |

The average annual precipitation in the Connecticut River Basin is fairly well established by records from 14 stations and over periods of observation of approximately 34 years. The average annual rainfall varies from about 45 inches in the southern portion to about 36 inches in the northern. In the vicinity of mountain peaks in Vermont and New Hampshire, however, the value may be as high as 60 inches for relatively small areas.

HARTFORD

EAST HARTFORD




HARTFORD, CONN. —— MARCH 20, 1936

The normal channel of the Connecticut River is indicated by the bridge in the left half of the picture. The flooded area on the extreme right is due to back-water in the Hockanum River. Dashed lines on this and succeeding pictures indicates proposed flood protection.

Records of run-off and stream flow have been established by the records of 46 United States Geological Survey gaging stations in the Connecticut Basin, of which 21 have been in operation for 20 years or longer. These data are also augmented by the records of municipal, utility, and private agencies.

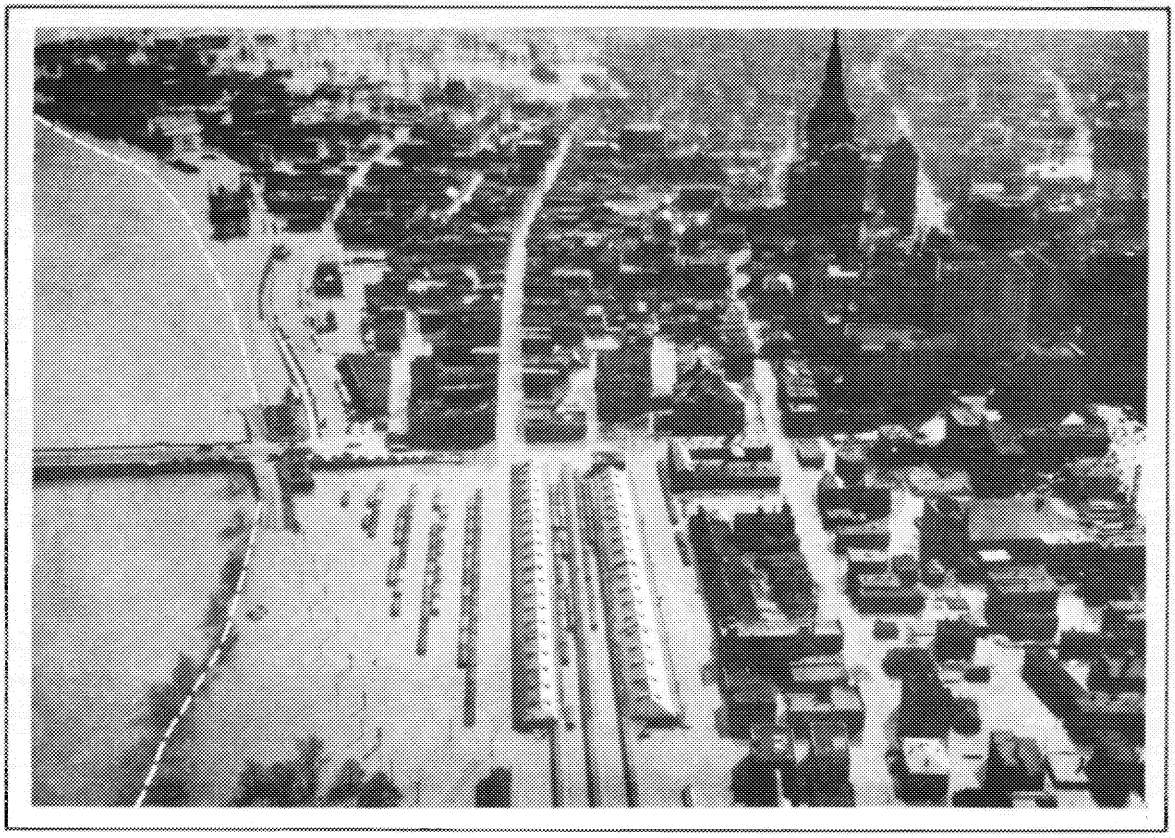
While records of past floods in the Connecticut Basin extend back nearly 300 years, complete hydrological data are available for comparatively recent floods only. Fairly good records have been kept for the last 100 years and form a reliable basis for determining probable frequencies of recurrence. Older historical records state but vaguely the magnitude of the floods.

In November 1927 an unusually severe flood occurred which caused damages estimated at about $15,000,000, mostly along tributary streams in Vermont. The rainfall from November 2 to November 4 in Vermont exceeded all previous records and swelled the tributary streams in this area to unprecedented proportions. The excessively large run-off, about 60 per cent, resulted from the ground being well saturated from a series of preceding minor rainfalls, in themselves somewhat in excess of normal.

The flood of March 1936 was by far the largest flood of record on the lower part of the Connecticut Basin. It was caused by a long, continuous, warm rain falling on a snow cover of from 10 to 40 inches and accompanied by an increase in temperature. In addition, the rainfall on the southern part of the basin started two days later than on the northern part, bringing relatively higher discharges from the lower tributaries into coincidence with the flood crest in the lower Connecticut River itself. Connecticut River floods of major proportions had previously resulted from excessive rainfall alone, or from run-off from melting ice and snow alone. In 1936 the great flood resulted from a combination of the two.

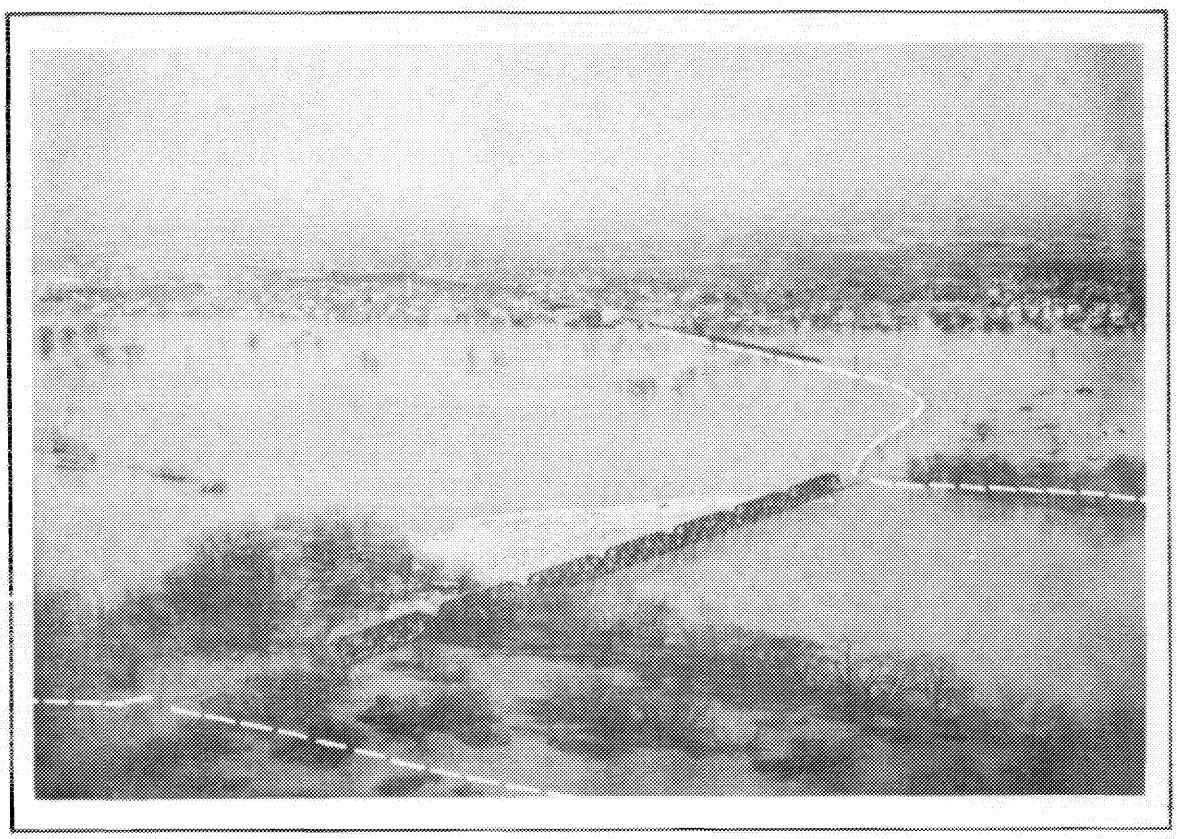
The direct losses in 1927 and 1936 are estimated as $15,526,000 and $34,500,000 respectively. Of the 1936 losses, 93.5 per cent have been classified as "recurring" losses, which can be reduced or eliminated by proper flood control measures. Indirect losses are highest in urban and industrial regions (114 per cent of direct losses) and lowest in rural areas (10 per cent of direct losses), and have a total value throughout the basin of 94.5 per cent of the direct recurring losses. The 1936 flood caused an estimated depreciation of property values of $74,857,000 in the area which will be protected by the Comprehensive Plan.

Average annual direct flood losses, determined from a mathematical solution of flood frequencies and estimated flood losses by zones at various stages, are put at about $1,280,000. Annual indirect flood losses are estimated to be in the neighborhood of $1,219,000. Annual losses from depreciation of property



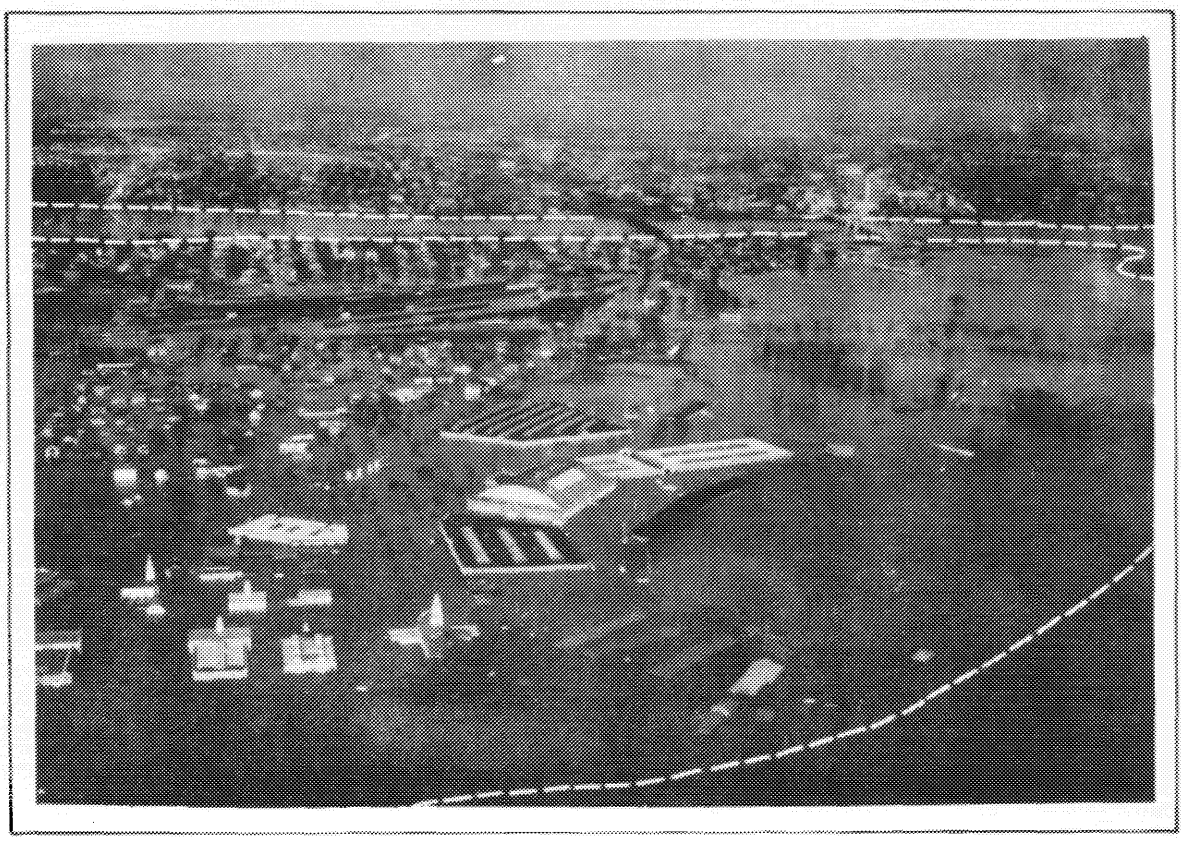
HARTFORD, CONN. — MARCH 22, 1936

HARTFORD, CONN. — MARCH 21, 1936



EAST HARTFORD, CONN. — MARCH 22, 1936

SPRINGFIELD, MASS. — MARCH 20, 1936

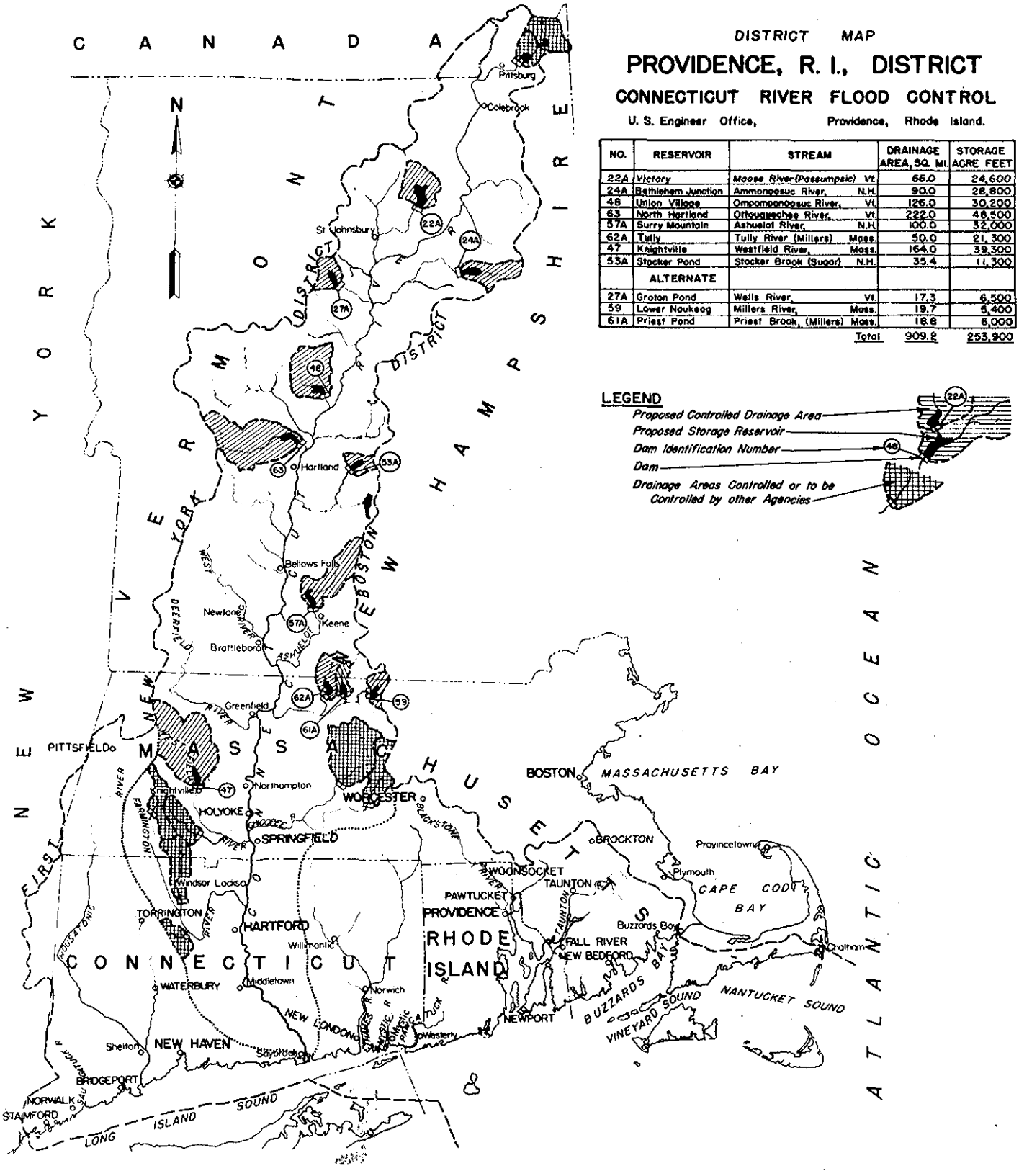


WEST SPRINGFIELD, MASS. — MARCH 20, 1936

CHICOPEE, MASS. — MARCH 20, 1936

HOLYOKE, MASS. — MARCH 21, 1936

NORTHAMPTON, MASS. — MARCH 20, 1936




DISTRICT MAP

# PROVIDENCE, R. I., DISTRICT

## CONNECTICUT RIVER FLOOD CONTROL

U. S. Engineer Office, Providence, Rhode Island.

| NO. | RESERVOIR | STREAM | DRAINAGE AREA, SQ. MI. | STORAGE ACRE FEET |
|---|---|---|---|---|
| 22A | Victory | Moose River (Possumpsic) Vt. | 66.0 | 24,600 |
| 24A | Bethlehem Junction | Ammonoosuc River, N.H. | 90.0 | 28,800 |
| 46 | Union Village | Ompompanoosuc River, Vt. | 126.0 | 30,200 |
| 63 | North Hartland | Ottauquechee River, Vt. | 222.0 | 48,500 |
| 57A | Surry Mountain | Ashuelot River, N.H. | 100.0 | 32,000 |
| 62A | Tully | Tully River (Millers) Mass. | 50.0 | 21,300 |
| 47 | Knightville | Westfield River, Mass. | 164.0 | 39,300 |
| 53A | Stocker Pond | Stocker Brook (Sugar) N.H. | 35.4 | 11,300 |
| | ALTERNATE | | | |
| 27A | Groton Pond | Wells River, Vt. | 17.3 | 6,500 |
| 59 | Lower Naukeag | Millers River, Mass. | 19.7 | 5,400 |
| 61A | Priest Pond | Priest Brook, (Millers) Mass. | 18.8 | 6,000 |
| | | Total | 909.2 | 253,900 |

LEGEND

- Proposed Controlled Drainage Area
- Proposed Storage Reservoir
- Dam Identification Number
- Dam
- Drainage Areas Controlled or to be Controlled by other Agencies

values, taken as the net annual loss of income as a result of the long term depreciation of values, amounted to about $3,597,000. These figures indicate a total annual loss of about $6,096,000 in the Connecticut River Basin chargeable to anticipated future floods in an inadequately protected valley.

APPROVED PROJECT.

The area below Hartford, Conn., or south of the watershed of the Farmington River, amounting to about 812 square miles, was found after extensive hydrological studies to have a negligible effect upon the flood losses of the valley. It may therefore be disregarded. The area above Fifteen Mile Falls, amounting to 1,650 square miles, not only has a measure of control, owing to existing works, but also lies with respect to the valley below it so that it does not contribute appreciably to the major peaks. Therefore it may also be disregarded.

The critical area in which flood damages may be excessive is that bounding and tributary to the Connecticut River between Hartford, Conn., and Fifteen Mile Falls, about two hundred and twenty-five miles above Hartford, amounting in all to about 8,798 square miles. This is approximately 78 per cent of the entire Connecticut Basin. Of this flood-producing area private power interests and reservoirs for domestic water supply afford control, varying from partial to complete, for only 681 square miles, or less than 8 per cent of the total contributing area.

The Approved Project was authorized by the Flood Control Act of 1936. It provides for the construction of eight dams costing $12,764,500 of which local interests are to pay $2,484,000 for lands and damages. The eight sites selected and three alternate sites are shown in Table II.

TABLE II

APPROVED PROJECT RESERVOIRS

| Reservoir | Stream | State | D. A. Sq. Mi. | Type of Dam | Type of Spillway |
|---|---|---|---|---|---|
| Victory | Moose (Passumpsic) | Vt. | 66.0 | Earth | Side-hill |
| Tully | Tully (Millers) | Mass. | 50.0 | do | Saddle |
| Surry Mountain | Ashuelot | N. H. | 100.0 | do | Side-channel |
| N. Hartland | Ottauquechee | Vt. | 222.0 | do | do |
| Union Village | Ompompanoosuc | do | 126.0 | do | Saddle |
| Stocker Pond | Sugar | N. H. | 35.4 | do | Side-hill |
| Knightville | Westfield | Mass. | 164.0 | do | Saddle |
| Bethlehem Jct. | Ammonoosuc | N. H. | 90.0 | do | Side-channel |
| | ALTERNATE SITES | | | | |
| Priest Pond | Millers | Mass. | 18.8 | Earth | Side-hill |
| Lower Naukeag | Millers | do | 19.7 | do | Overflow section |
| Groton Pond | Wells | Vt. | 17.3 | Rock fill & concrete | Overflow section |

These dams of the eight approved project reservoirs will control a total drainage area of 853.4 square miles and have a combined capacity of 236,000 acre-feet. Funds have not yet been provided for the construction of any of these dams.

There is also contemplated the construction or augmentation of seven local protective systems at Hartford, East Hartford, Springfield, West Springfield, Chicopee, Holyoke, and Northampton. These protective systems include earth dikes, concrete walls, pumping plants, and related structures. Recommendation has been made that the United States bear the costs of construction of the dikes, walls, pumping plants, and related works, and that local interests contribute the costs of lands, damages, intercepting sewers and other drainage works involved. This recommendation is now before the Congress awaiting legislation approving, authorizing, and appropriating funds for the proposed construction. The estimated cost to the United States is $11,524,000; to local interests $1,264,000; or a total estimated cost of $12,788,000.

Construction operations are now under way on local protective measures including dike and flood wall construction at Springfield and West Springfield, Mass., and Hartford, Conn. The work is being performed with funds allotted from the Emergency Relief Appropriation Act of 1937.

The work at West Springfield consists principally of the enlargement of an existing dike 6,100 linear feet long, just south of the Agawam Bridge along the Eastern States Exposition Grounds on the Westfield River. The completion of this work will protect the town of West Springfield against a flood of the magnitude of the 1936 flood.

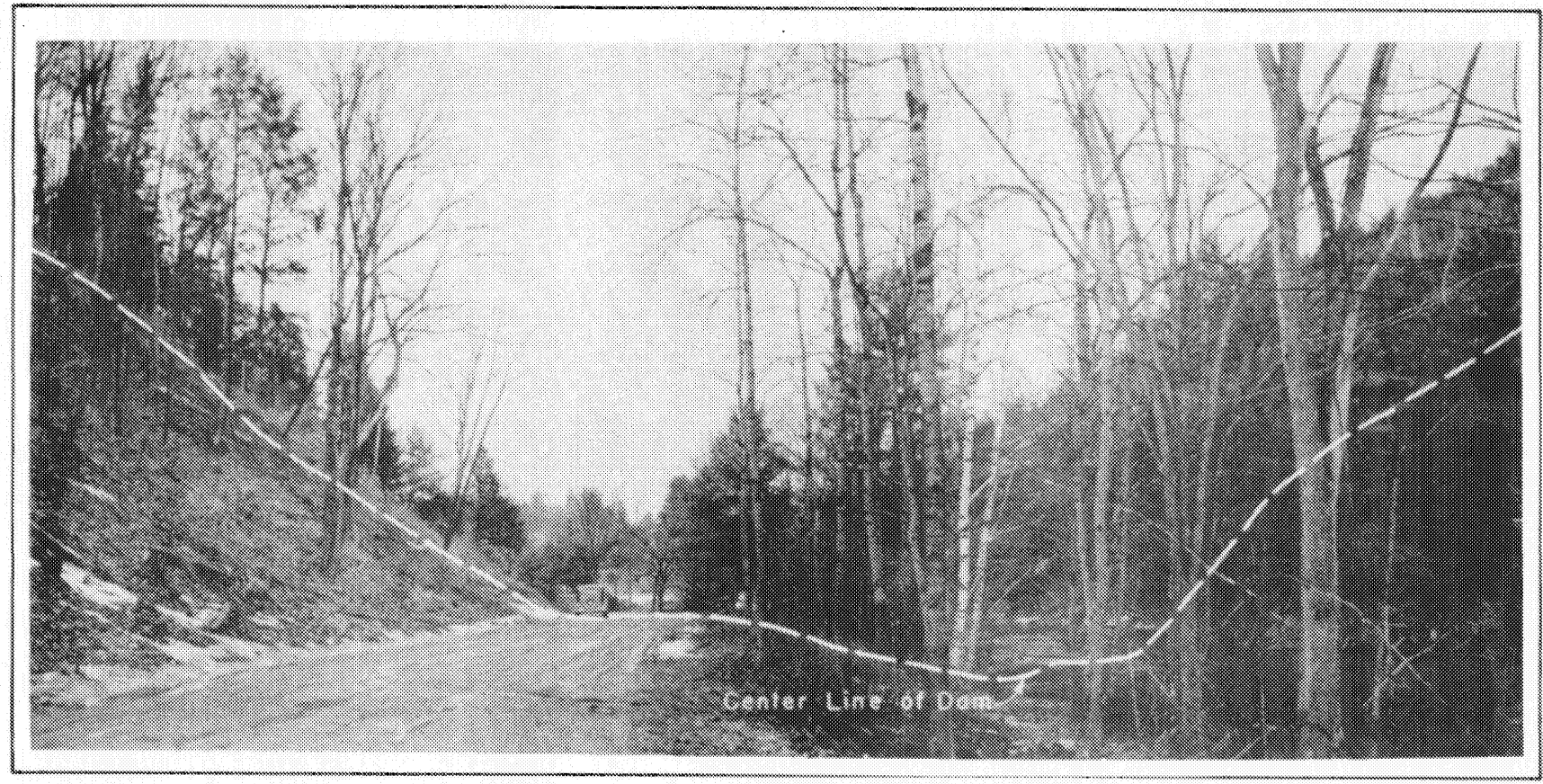
The Springfield work consists of the construction of approximately 3,200 linear feet of earth dike and 1,000 feet of concrete flood wall along the Connecticut River between the North End Bridge and the Boston and Albany Railroad Bridge. The construction will give protection to that portion of Springfield north of the Boston and Albany Railroad against floods of the magnitude of that of 1936.

The project at Hartford covers the enlargement of approximately 11,600 feet of the Clark Dike between the New York, New Haven, and Hartford Railroad near Wethersfield Avenue and the Airport Road near the National Guard Hangar. This work is the beginning of construction which when completed will afford protection against floods of greater magnitude than the 1936 flood.

Detailed designs including contract plans and specifications are being made for the Approved Project dams at Union Village, Vt., Surry Mountain, N. H., and Knightville, Mass.

UNION VILLAGE DAM AND RESERVOIR.

The Union Village Dam is to be located just north of the town of Union Village, Orange County, Vt., on the Ompompanoosuc River, about four miles above its confluence with the Connecticut.

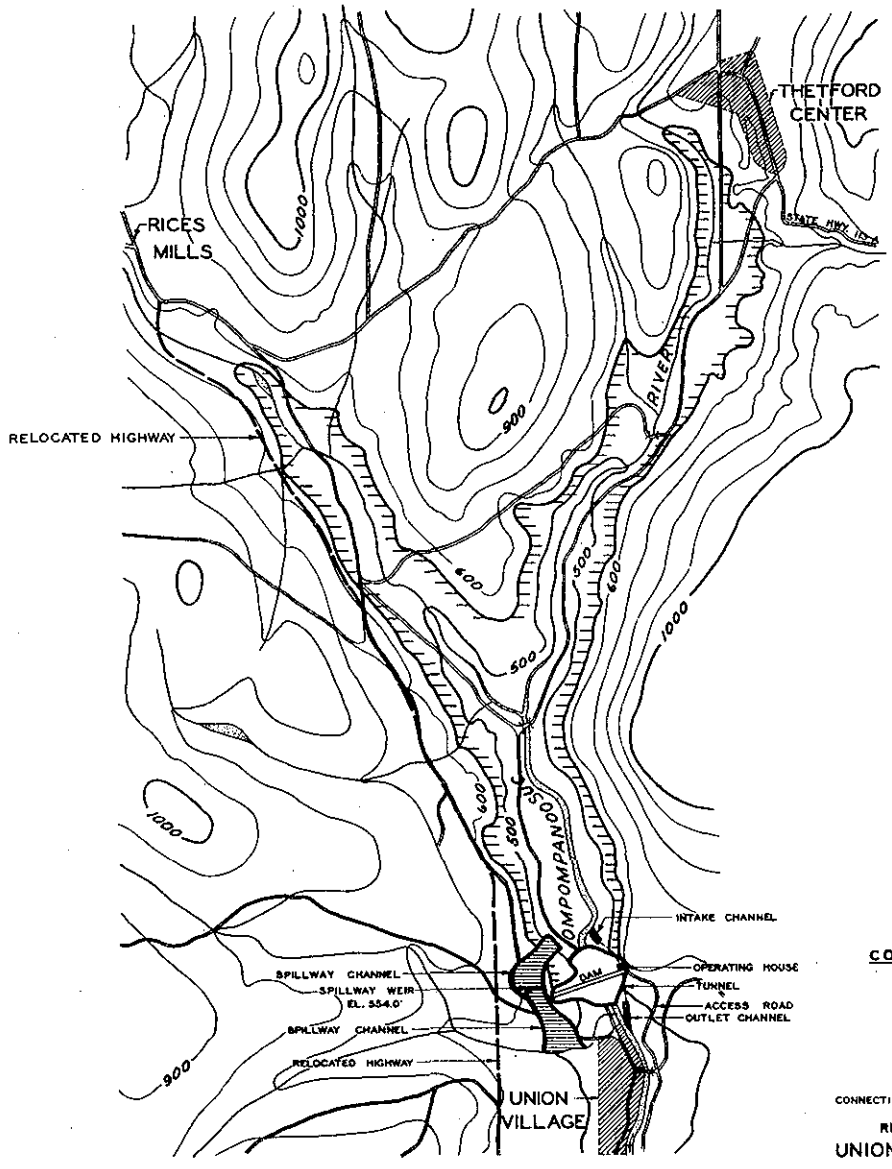



UNION VILLAGE, VERMONT

View of Dam Site from downstream

WAR DEPARTMENT

CORPS OF ENGINEERS, U.S. ARMY




CONFERENCE EXHIBIT

CONNECTICUT RIVER FLOOD CONTROL

RESERVOIR MAP

UNION VILLAGE DAM

NO. 48

OMPOMPANOOSUC R., VERMONT

U.S. ENGINEER OFFICE

PROVIDENCE, R.I.

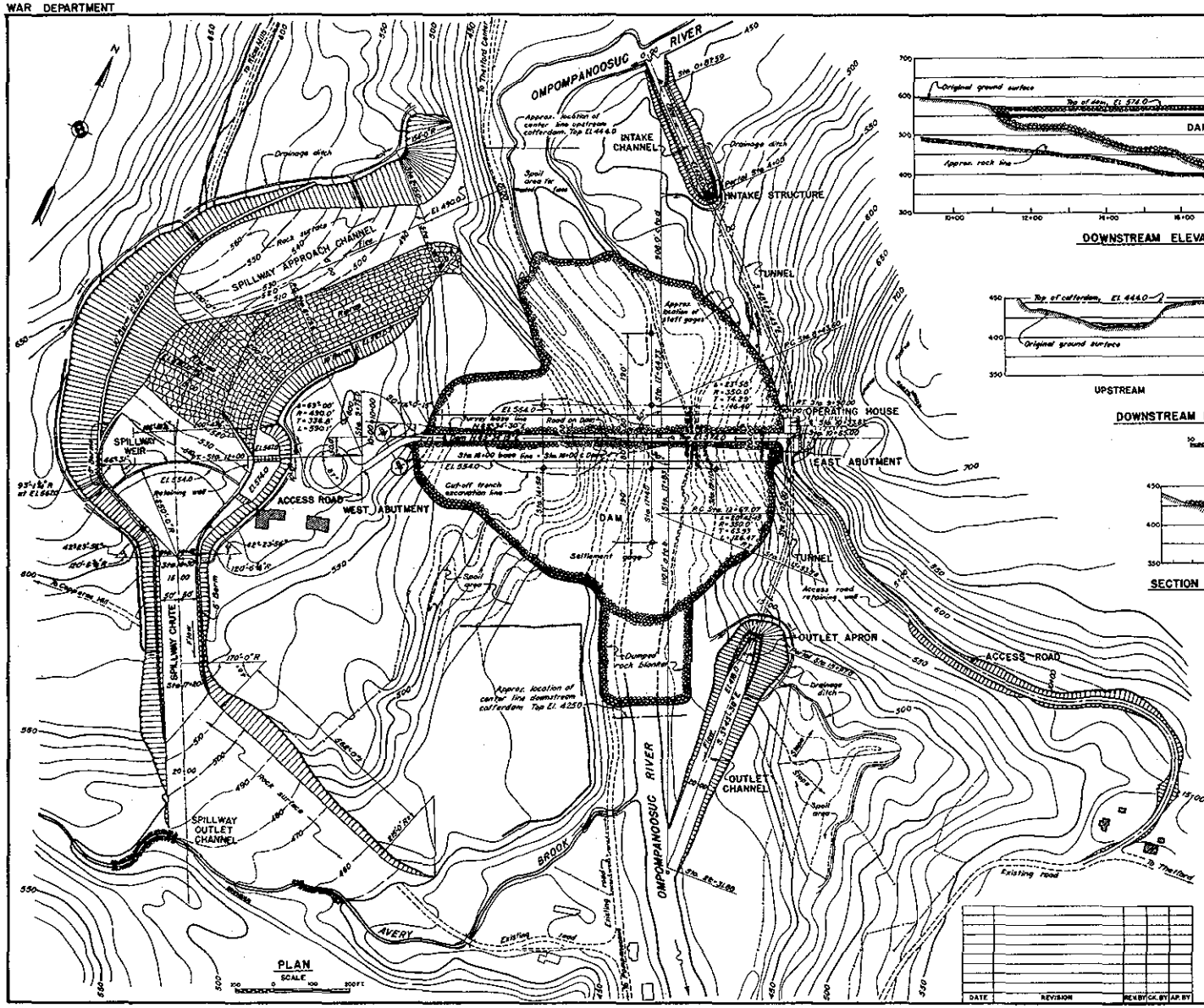
SCALE

0 1/4 1/2 MI.

CT-1-1089

WAR DEPARTMENT

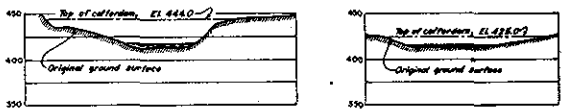
CORPS OF ENGINEERS, U. S. ARMY



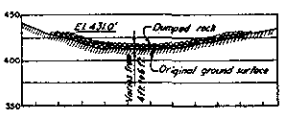




DOWNSTREAM ELEVATION OF DAM




DOWNSTREAM ELEVATIONS OF COFFERDAMS (1)




SECTION THRU DUMPED ROCK BLANKET

NOTES

Elevations refer to Mean Sea Level Datum.
Contour Interval = 10 Feet.
For details of embankment see Sheets No. 9 to 11 inclusive.
For details of roadway see Sheets No. 13 to 15 inclusive.
For details of tunnel see Sheets No. 16 to 56 inclusive.
For details of shaft see Sheets No. 25 to 28 inclusive.
For details of operating house see Sheets No. 57 to 61 inclusive.
For details of drainage ditch see Sheet No. 12
For details of access road see Sheets No. 7 and 63
Figure in hexagon indicates bid item number under which payment will be made.

CONNECTICUT RIVER FLOOD CONTROL

# UNION VILLAGE DAM
## GENERAL PLAN

OMPOMPANOOSUC RIVER, VERMONT

IN 63 SHEETS — SCALES AS SHOWN — SHEET NO. 6

U.S. ENGINEER OFFICE, PROVIDENCE, R.I. 1938

| DATE | REVISION | REVISED BY | CK. BY | AP. BY |
|---|---|---|---|---|
| | | | | |

SUBMITTED: [signature] DIVISION ENGINEER

APPROVED AND RECOMMENDED: [signature] CHIEF, ENGINEERING SECTION

APPROVED: [signature] CHIEF, FLOOD CONTROL BR.

APPROVED: [signature] LT. COL. C.E. DISTRICT ENGINEER

DESIGNED: [signature] ENGINEER

DRAWN BY H.E.N.

TRACED BY H.E.M. BECK

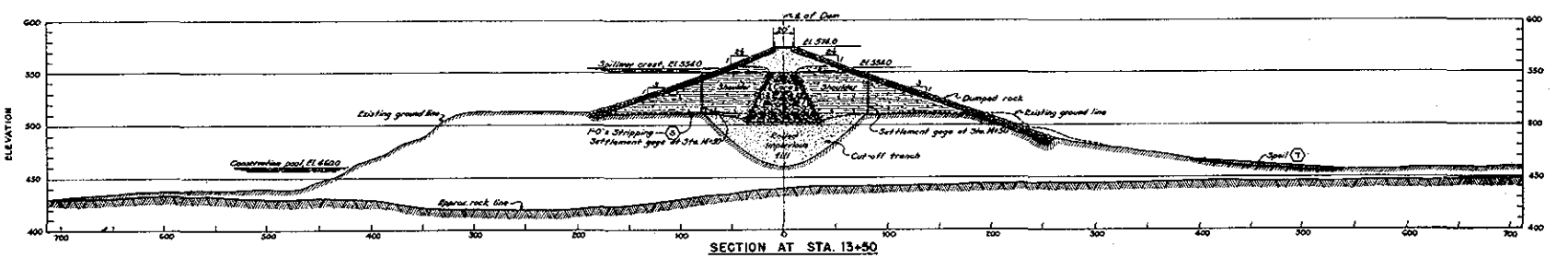
CHECKED BY C.B.H.

FILE NO CT-1-1156

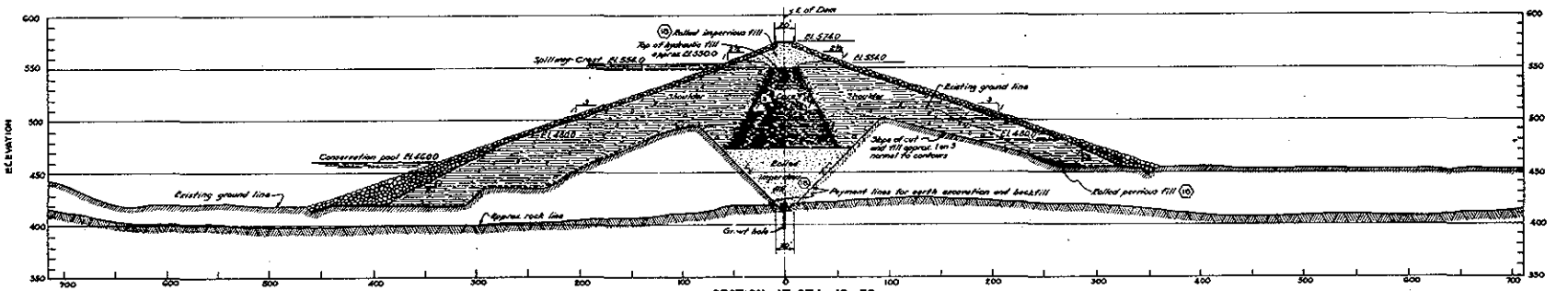
In accordance with specifications

WAR DEPARTMENT

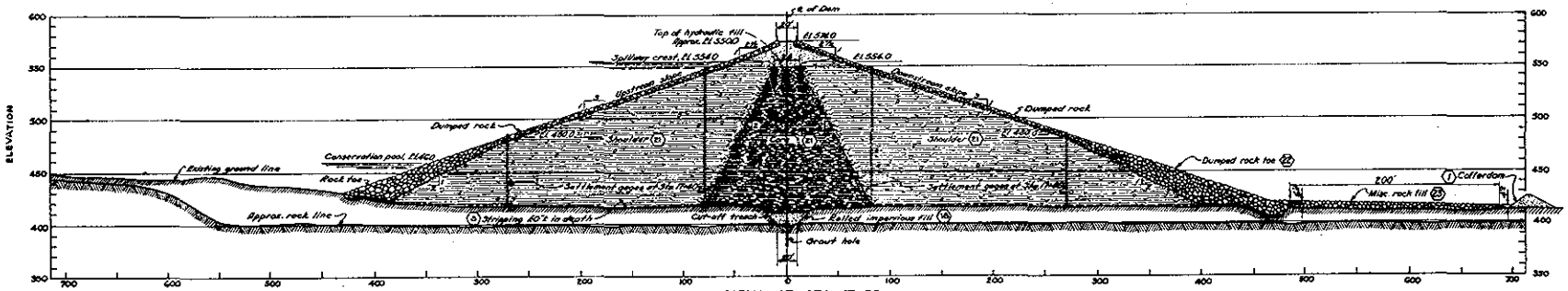
CORPS OF ENGINEERS, U.S. ARMY




SECTION AT STA. 13+50




SECTION AT STA. 15+30




SECTION AT STA. 17+30

NOTES

For general notes applying to details on this sheet see sheet No. 9

CONNECTICUT RIVER FLOOD CONTROL

UNION VILLAGE DAM

EMBANKMENT DETAILS NO. 2

OMPOMPANOOSUC RIVER, VERMONT.

W.O. SHEETS — SCALE AS SHOWN — SHEET NO 10

U.S. ENGINEER OFFICE, PROVIDENCE, R.I. 1936

SUBMITTED: APPROVAL RECOMMENDED: APPROVED:

DESIGNED: DRAWN BY: TRACED BY: CHECKED BY:

FILE NO. CT-1-1150

DATE REVISION ELEVATION AT LAP. BT.

The dam will be a hydraulic-fill earth embankment, 160 feet high and 987 feet in length. It will have a top width of 20 feet and a maximum base width of 950 feet. A total of approximately 1,000,000 cubic yards of earth and 180,000 cubic yards of rock will be used to construct the embankment.

A flat crested, curved spillway, 370 feet long, constructed on rock on the right bank, is designed to discharge 52,000 cubic feet per second under a 13-foot surcharge. Its discharge will be carried around the dam proper in a wide channel to a point well below the toe of the dam, where it will rejoin the river.

A concrete-lined horseshoe shaped tunnel, 13 feet in diameter and 1,200 feet long, located in rock on the left bank, will provide reservoir control. Flow through the tunnel will be controlled by two caterpillar type gates operating in a vertical shaft located near the center of the tunnel. Machinery and other equipment necessary to operate the gates will be housed in an operating house directly above the gate shaft.

When completed, the dam will have a storage capacity of 30,200 acre-feet of water, equivalent to 4.5 inches of run-off over the drainage area of 126 square miles above the dam. The reservoir will have an area of about 600 acres at spillway elevation and will extend about four miles upstream.

SURRY MOUNTAIN DAM AND RESERVOIR.

The Surry Mountain Dam will be in Cheshire County, about five miles northwest of Keene, N. H., on the Ashuelot River, about 34 miles above its confluence with the Connecticut River.

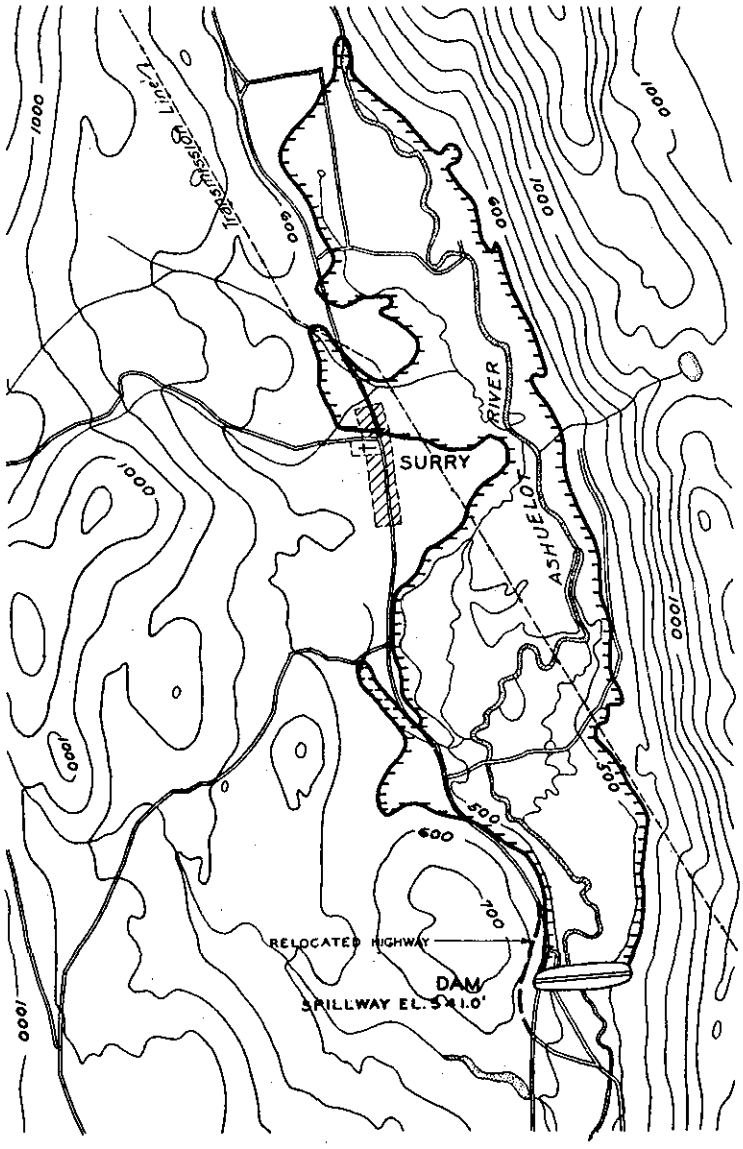
The dam is to be a rolled-fill earth embankment, 1,680 feet long and 85 feet high. It will have a top width of 30 feet and an average base width of 500 feet. A total of approximately 740,000 cubic yards of earth and 160,000 cubic yards of rock will be required to construct the embankment.

An open side-channel spillway, 360 feet long, having a maximum capacity of 41,000 cubic feet per second under a 10-foot surcharge will be constructed on the right bank. Its discharge will be carried in a 30-foot wide channel to a point well below the toe of the dam, where it will rejoin the river.

A concrete-lined horseshoe type tunnel, 10 feet in diameter and 390 feet long, driven through rock in the right bank, will provide reservoir control. Flow through the tunnel will be controlled by two Broome gates operating in a vertical shaft located on the upstream side of the dam. Machinery and other equipment necessary to operate the gates will be housed in the operating house directly above the gate shaft.

WAR DEPARTMENT

CORPS OF ENGINEERS, U.S. ARMY




CONNECTICUT RIVER FLOOD CONTROL

RESERVOIR MAP

# SURRY MOUNTAIN DAM

NO. 57-A

ASHUELOT RIVER, NEW HAMPSHIRE

U.S. ENGINEER OFFICE

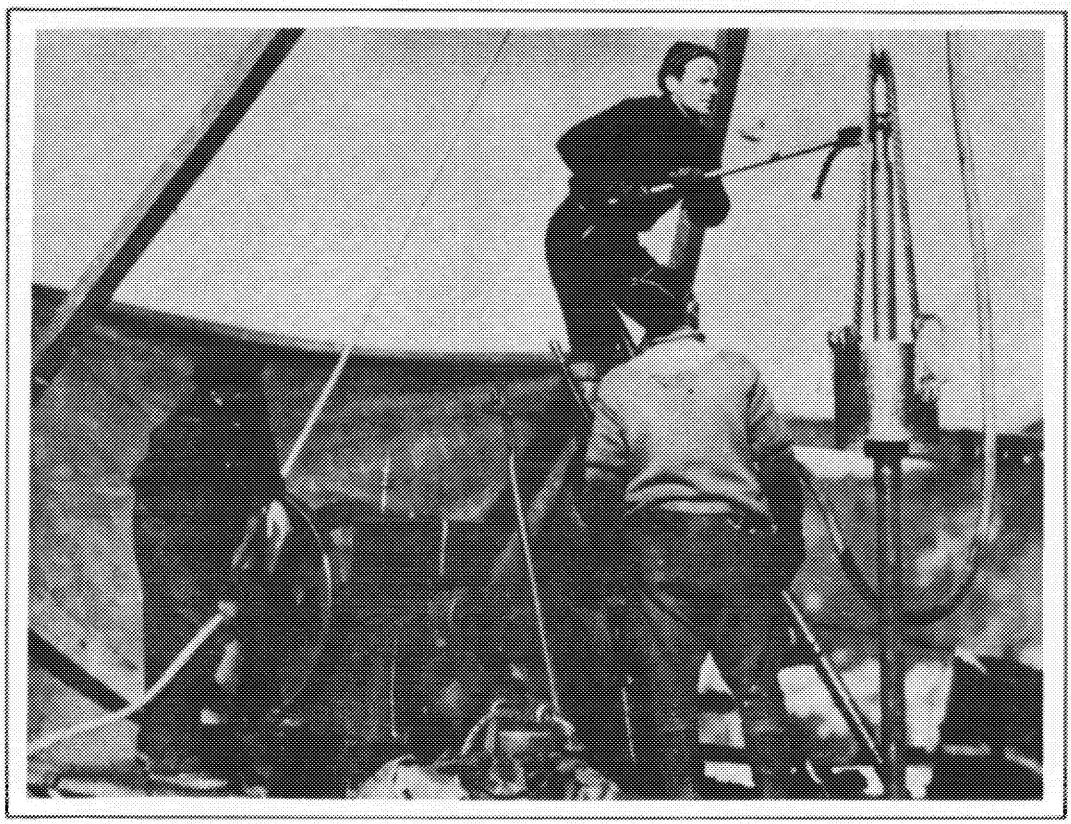
PROVIDENCE, R.I.

SCALE

0 ½ 1 MI.

IN 3 SHEETS SHEET NO. 1

CT-1-1033 A



SURRY MOUNTAIN, NEW HAMPSHIRE
Overburden drilling. Washing out casing in compact material.

SURRY MOUNTAIN, NEW HAMPSHIRE
Showing drill-rig on right abutment at center line of proposed dam.

When completed, the dam will have a storage capacity of 32,500 acre-feet of water, equivalent to 6.1 inches of run-off over the drainage area of 100 square miles above the dam. The reservoir will be three miles in length and have an area of about 970 acres at spillway elevation.

KNIGHTVILLE DAM AND RESERVOIR.

The Knightville Dam is to be located north of the town of Knightville, in Hampshire County, Mass., on the Westfield River, about 25 miles above its mouth.

It is proposed to construct a hydraulic-fill earth embankment with a height of 140 feet and a length of 1,000 feet. At the top it will be 20 feet wide with a maximum base width of 885 feet.

A concrete spillway is designed to pass 48,400 cubic feet of water per second into the spillway channel.

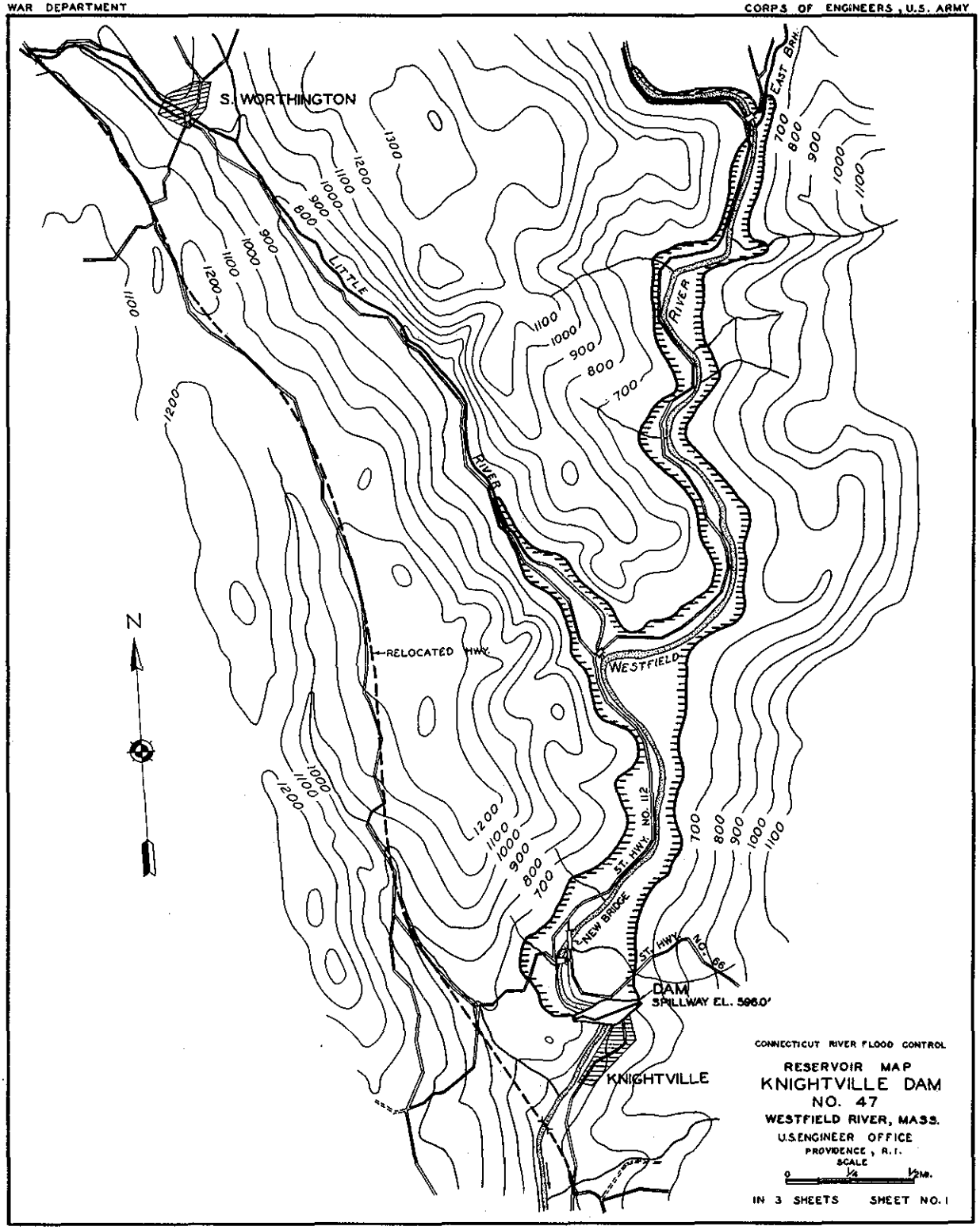
Flowage will pass through a tunnel, 850 feet long and 17.5 feet in diameter, excavated through rock in the right abutment. Two gates, electrically operated from an operating house on top of the concrete section of the dam, will control this flow.

It is estimated that it will take two years to build this dam and it will require the placing of about one million cubic yards of earth.

The reservoir will impound 39,300 acre-feet of water, equivalent to a run-off of 4.5 inches from the watershed of 164 square miles above the dam. The reservoir will have an area of about 860 acres and will extend about four miles upstream.

WAR DEPARTMENT

CORPS OF ENGINEERS, U.S. ARMY




CONNECTICUT RIVER FLOOD CONTROL

RESERVOIR MAP

KNIGHTVILLE DAM

NO. 47

WESTFIELD RIVER, MASS.

U.S. ENGINEER OFFICE

PROVIDENCE, R.I.

SCALE

0 ¼ ½ MI.

IN 3 SHEETS SHEET NO. 1

CT-1-1058